REMARKS

Claims 1-15 are pending in this application. By this Amendment, claims 1, 3, 8 and 14 are amended. No new matter is added. Reconsideration of the application is respectfully requested.

Entry of the amendments is proper under 37 CFR §1.116 since the amendments: (a) place the application in condition for allowance for the reasons discussed herein; (b) do not raise any new issue requiring further search and/or consideration since the amendments amplify issues previously discussed throughout prosecution; (c) do not present any additional claims without canceling a corresponding number of finally rejected claims; and (d) place the application in better form for appeal, should an appeal be necessary. The amendments are necessary and were not earlier presented because they are made in response to arguments raised in the final rejection. Entry of the amendments is thus respectfully requested.

I. Rejections Under 35 U.S.C. §103(a)

The Office Action rejects claims 1-7 under 35 U.S.C. §103(a) over U.S. Patent No. 3,145,563 to Hollander, Jr. ("Hollander") in view of U.S. Patent No. 3,251,222 to Fenner; rejects claims 8-13 under 35 U.S.C. §103(a) over Hollander in view of Fenner, and further in view of U.S. Patent No 5,526,700 to Akeel; and rejects claims 14-15 under 35 U.S.C. §103(a) over Hollander in view of over U.S. Patent No. 4,546,658 to Rocha et al. ("Rocha"). Applicants respectfully traverse the rejections.

Hollander does not teach or suggest a force sensing element in which "an electric current input terminal and a sensor output terminal include a same one of the plurality of electrodes," as recited in independent claims 1, 3, 8 and 14.

The Office Action asserts that Hollander teaches a force sensing element including a gauge portion 10 and a plurality of electrodes 16. See Fig. 1. Notwithstanding these assertions, Hollander does not teach or suggest that an electric current input terminal and a

sensor output terminal include a same one of the plurality of electrodes, as set forth in claims 1, 3, 8 and 14.

Hollander teaches a piezoresistive transducer including a slab 10 of single crystal p-type PbTe and centrally located electrodes 16, 18. See Fig. 1. Hollander also teaches a battery 30 supplying an input voltage to electrodes 16, and thus resulting in a voltage gradient in the direction indicated by arrow 15 in which the shear forces are applied. See Fig. 1, and col. 2, lines 45-47. Therefore, the electrodes 16 serve as input terminals that make electric current flow through the slab 10 in the direction of arrow 15, i.e., a thickness direction which is the same direction that the shear forces are applied.

Although the application of shear forces produces changes in the resistivity of the slab 10, Hollander teaches that an output voltage E_{out} is measured across electrodes 18, i.e., in a direction different from the direction arrow 15. Fig. 1, col. 3, lines 3-9 and 16-22. Therefore, the electrodes 18 serve as output terminals of output voltage E_{out}. Because the electrodes 16 used for input and the electrodes 18 used for output do not share a common electrode, the piezoresistive transducer of Hollander requires four wires, e.g., one for each electrode, to input voltage and measure the output voltage E_{out}. Hollander does not teach or suggest an electric current input terminal and a sensor output terminal including a same electrode.

In the force sensing elements of claims 1, 3, 8 and 14 a constant current is applied to a force sensing element via two input electrodes. See paragraphs [0042] and [0048] of the specification. When a load is applied to a force transmission body and subsequently transmitted to an upper electrode of a sensing element portion, the load presses a gauge portion located between the upper electrode and a lower electrode. Because the current is constant, a resistance change in the gauge portion results in a change in voltage.

The voltage change is measured across the same two input electrodes. Therefore, the force sensing element may use the same two wires to both input current and output a change

in voltage. The change in voltage is measured along an electric voltage output path that travels in the same direction, i.e., a thickness direction, that the load and the current are applied. In other words, an output terminal of the output voltage is the same as at least one of the input electrodes. As a result, the force sensing element is structurally simplified and may be more easily produced. Hollander does not provide such advantages.

The Office Action asserts that Fenner, Akeel and Rocha remedy the deficiencies of Hollander. However, Fenner, Akeel and Rocha do not remedy the deficiencies of Hollander for the reasons discussed below.

Fenner teaches a strain gauge that includes a semiconductor strain sensitive element 1, electrode terminals 2-5 and current carrying portions 6-9. See Fig. 2. Fenner also teaches a battery 11 supplying an input voltage to the electrodes 2, 4. Therefore, the electrodes 2,4 serve as input terminals that make electric current flow in the current carrying portions 7, 8 in a direction parallel to a strain direction A and that make electric current flow in the current carrying portions 6, 9 in a direction perpendicular to the strain direction A. See col. 7, lines 2-15.

However, Fenner teaches that a detecting means 12, e.g., a voltmeter, measures an output voltage change across the electrodes 3, 5, e.g., in a direction <u>different</u> from the strain direction A. See Fig. 2, col. 5, lines 67-71 and col. 7, lines 29-49. Therefore, the electrodes 3, 5 serve as output terminals of output voltage E_{out}. Because the electrodes 2, 4 used for input and the electrodes 3, 5 used for output <u>do not</u> share a common electrode, the strain gauge of Fenner requires four wires, e.g., one for each electrode, to input voltage and measure the output voltage E_{out}. Fenner does not teach or suggest an electric current input terminal and a sensor output terminal including a same electrode.

Akeel is directed to a six component force gauge 10 including a central column 16 and strain sensitive sensors 46, 48 and 50. See Figs. 1 and 3. However, Akeel does not teach or

suggest an electric current input terminal and a sensor output terminal including a same electrode.

Rocha teaches a piezoelectric force/pressure sensor 10 including transducers 11, 12 having piezoelectric members 15, 15', and a coupling layer 14 provided between electrodes 16, 18. See Fig. 2. Contrary to the force sensing element of Hollander that measures a piezoresistive effect, the piezoelectric force/pressure sensor 10 of Rocha teaches measuring a piezoelectric effect, i.e. a change in frequency produced in the coupling layer 14. See Fig. 2, and col. 4, lines 32-39. Because piezoelectric sensors measure change in polarity and piezoresistive transducers measure change in resistance, neither Hollander nor Rocha provide any motivation to combine a piezoresistive transducer and piezoelectric sensors. Such combination would render either type of transducer/sensor inoperable. Therefore, Rocha cannot properly be relied upon to remedy the deficiencies of Hollander.

As such, a person having ordinary skill in the art of force sensing elements would not combine the teachings of Hollander and Rocha to teach or suggest a force sensing element including "a first semiconductor substrate, a gauge portion which is formed on one main face of the first semiconductor substrate and which is pressed upon receiving a force, a second semiconductor substrate which is joined on the side of one main face thereof to the gauge portion of the first semiconductor substrate, a first electrode which is formed on the first semiconductor substrate, and a second electrode which is formed on the second semiconductor substrate, wherein a current path, which extends in the same direction as a force is applied to the gauge portion, is formed of the first electrode and the second electrode, and wherein gauge portion has a piezoresistance effect, and wherein an electric current input terminal and a sensor output terminal include a same one of the plurality of electrodes," as recited in independent claim 14.

Because neither Fenner nor Akeel teach or suggest an electric current input terminal and a sensor output terminal include a same one of the plurality of electrodes, Hollander, Fenner and Akeel do no teach or suggest, alone or in combination, the force sensing element of claims 1, 3, 8 and 14. Further, because Rocha cannot be combined with Hollander to remedy the deficiencies of Hollander, Rocha and Hollander do not teach or suggest the force sensing element of claim 14.

For at least the reasons discussed above, Hollander, Fenner, Akeel and Rocha, alone or in combination, would not have rendered obvious the force sensing elements of claims 1, 3, 8 and 14. Claims 2 and 4-7, 9-13 and 15 variously depend from claims 1, 3, 8 and 14, and thus also would not have been rendered obvious by Hollander in view of Fenner, Akeel and Rocha for at least the reasons set forth above, as well as for the additional features they recite. Accordingly, reconsideration and withdrawal of the rejection are respectfully requested.

II. Conclusion

In view of the foregoing, it is respectfully submitted that this application is in condition for allowance. Favorable reconsideration and prompt allowance of claims 1-15 are earnestly solicited.

Should the Examiner believe that anything further would be desirable in order to place this application in even better condition for allowance, the Examiner is invited to contact the undersigned at the telephone number set forth below.

Respectfully submitted,

James A. Oliff
Registration No. 27,075

Holly N. Moore
Registration No. 50,212

JAO:HNM/cfr

Date: July 20, 2005

OLIFF & BERRIDGE, PLC
P.O. Box 19928
Alexandria, Virginia 22320
Telephone: (703) 836-6400

DEPOSIT ACCOUNT USE AUTHORIZATION
Please grant any extension necessary for entry;
Charge any fee due to our Deposit Account No. 15-0461